

ARCNL's Laser-produced Plasma EUV Source

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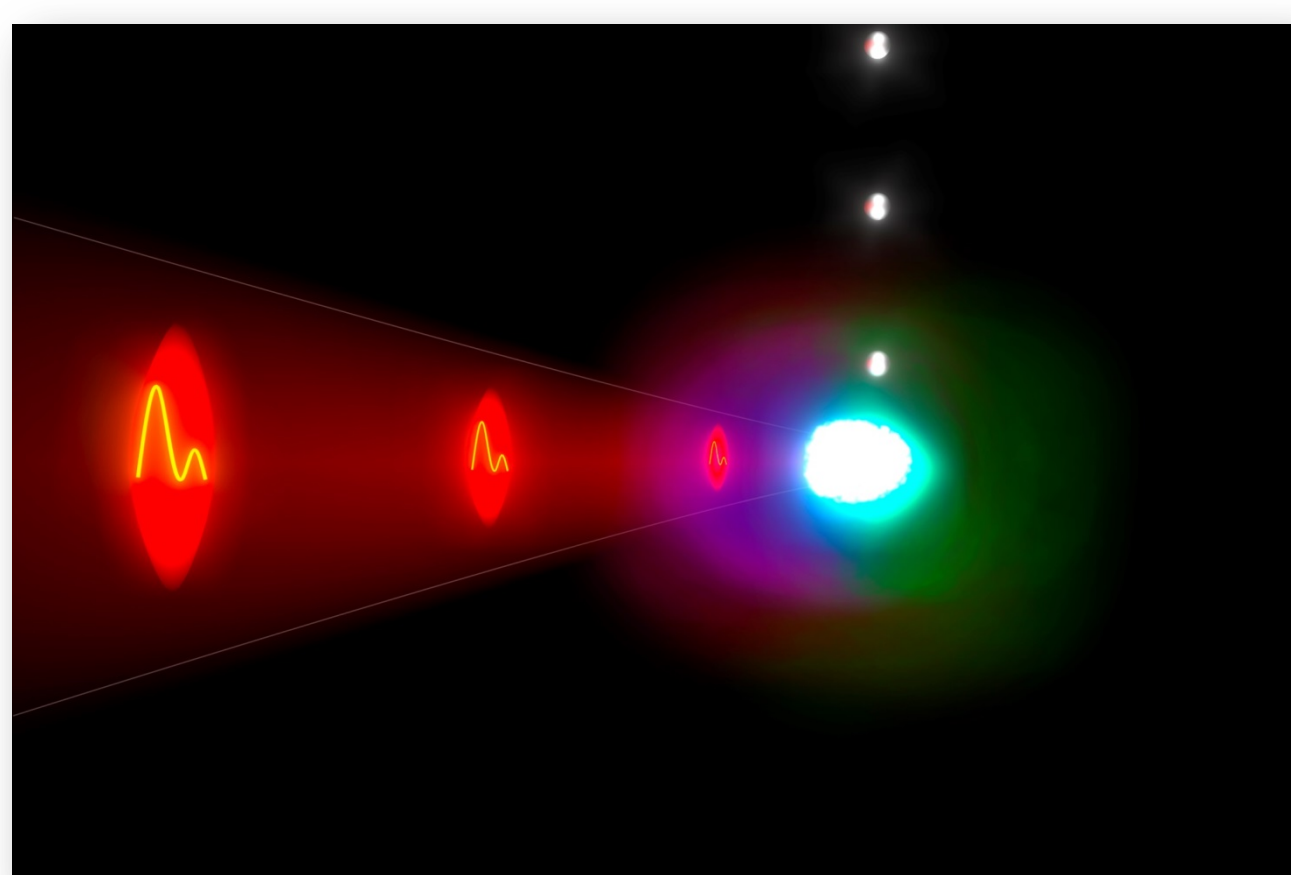
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Synopsis The EUV Plasma Dynamics group at ARCNL aims at the understanding of the physics of laser-produced plasma (LPP) EUV sources on an atomic and molecular level, underpinning the operation of contemporary and future light sources for nanolithography.

Fundamental investigations of laser-produced plasma for a 13.5nm Extreme Ultra-Violet (EUV) light source



The grand challenges:

Increase and optimization of the in-band EUV conversion efficiency (CE)

Reduction and control of fast multicharged plasma-born Sn^{X+} ions

Minimize damage to plasma-facing components

AND think ahead ...

Develop models to decide on future routes for plasma EUV generation

What other materials and processes can we use to generate EUV?

„in-vitro“ high-precision spectroscopy: light and ions

Laser spectroscopic investigations of plasma produced molecules and radicals Sn_xH_y using setups at VU and ARCNL.

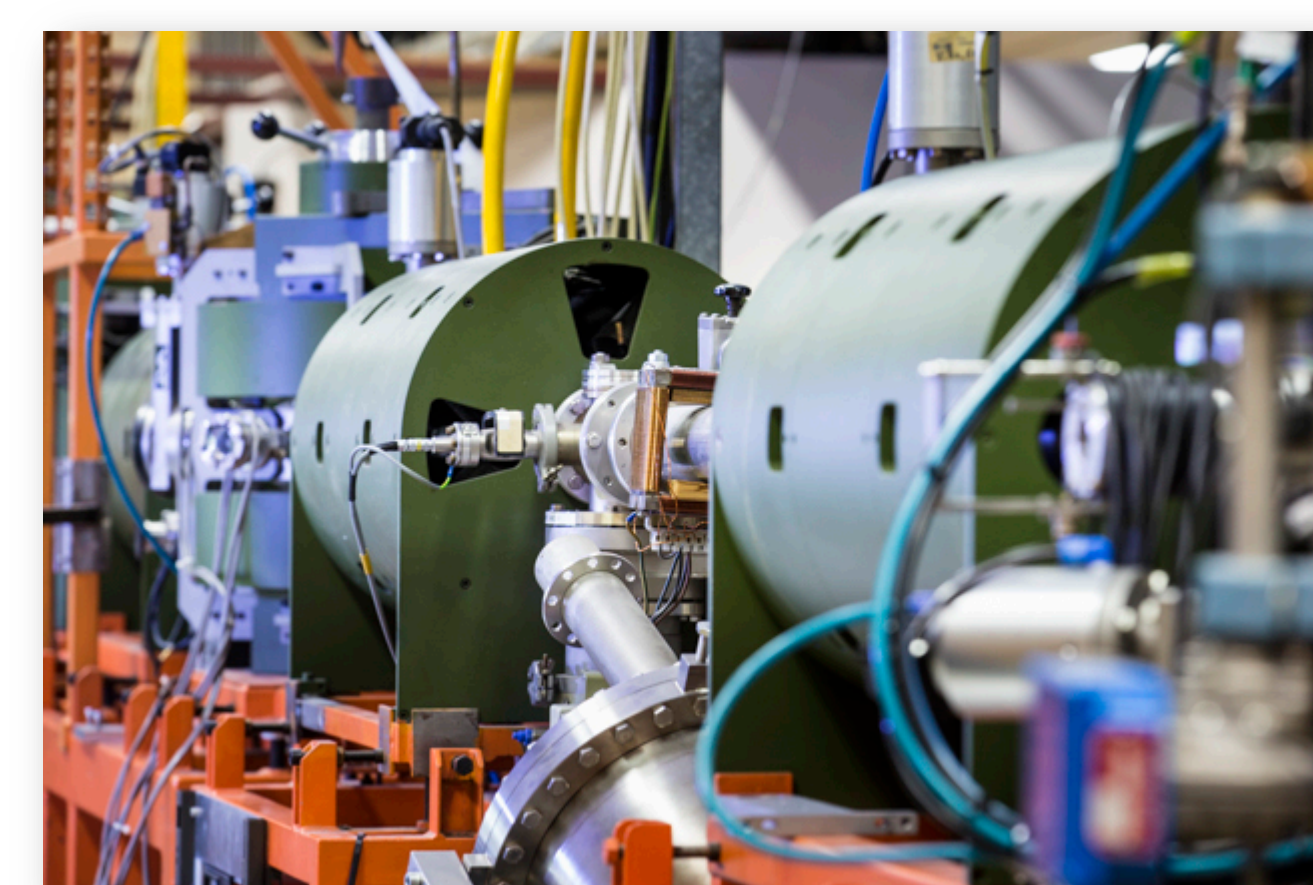
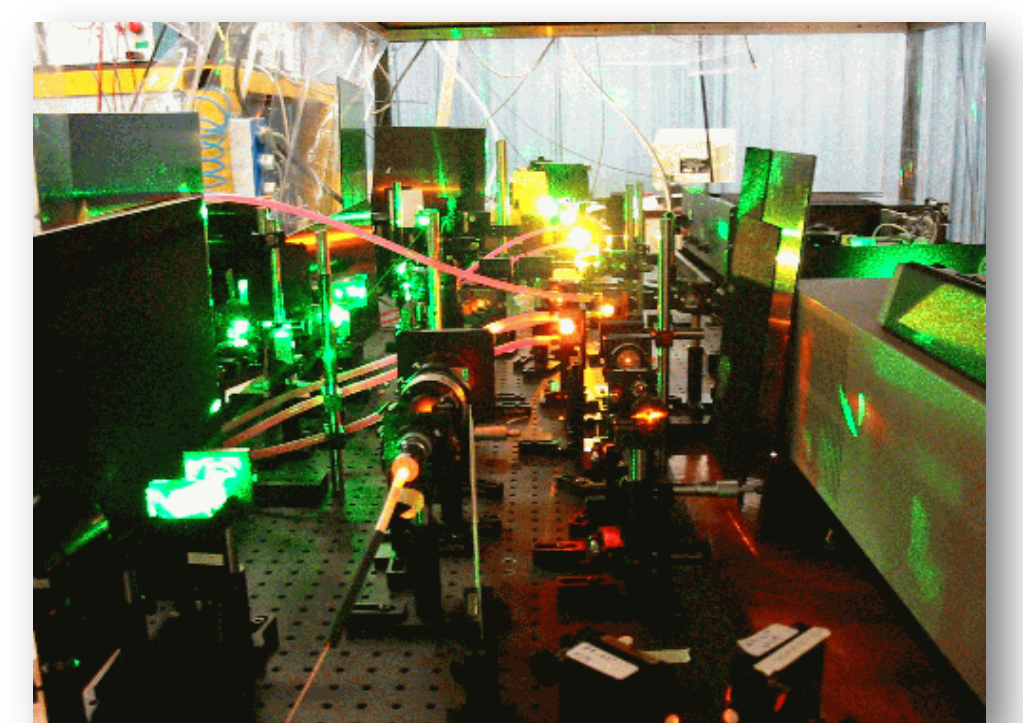
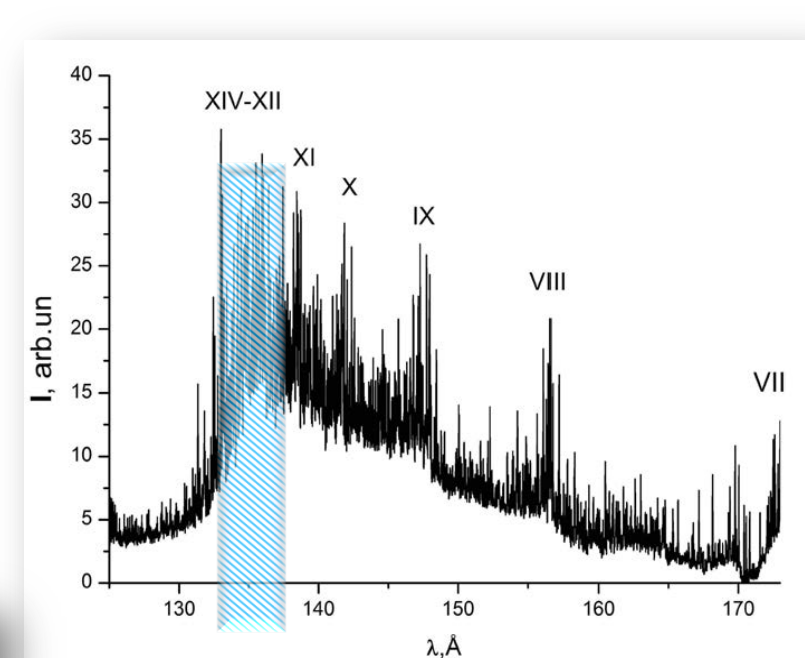


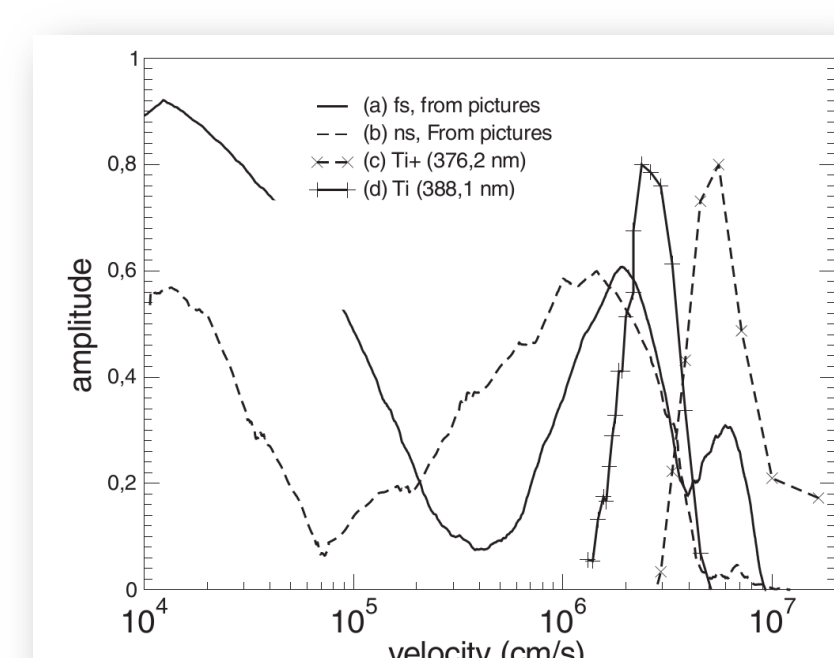
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Collisional cross-sections: tin-matter interactions using available beamline facilities in Groningen.

Plasma diagnostics: temporally and spatially resolved spectroscopy and imaging in functional EUV source



in and out-of-band EUV from a Tin-LPP

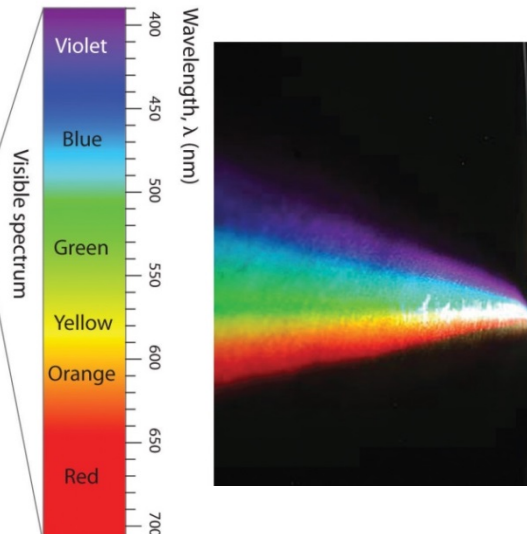


velocity distributions of ions and debris

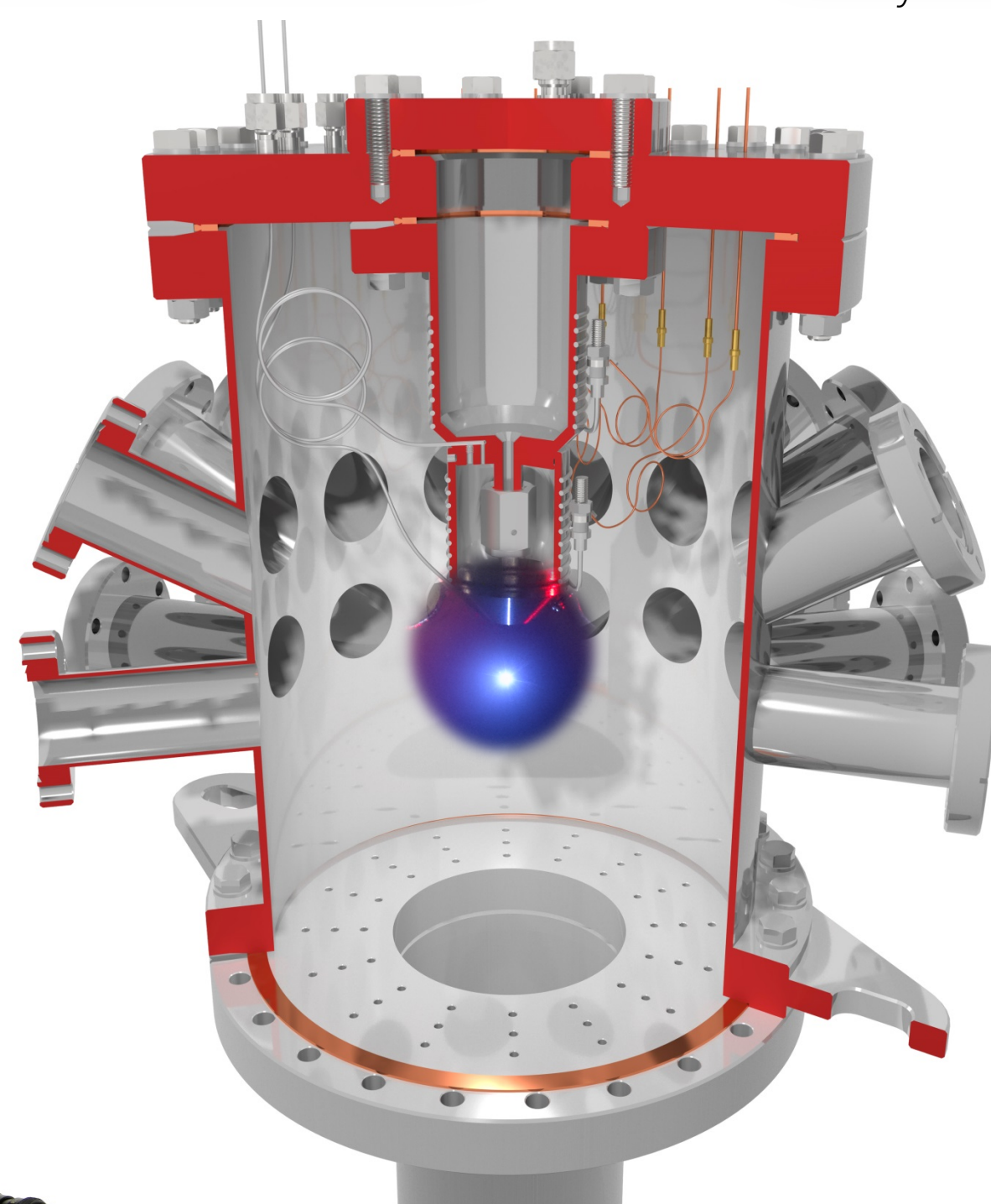
Passive EUV-DUV-optical spectroscopy



EUV spectroscopy



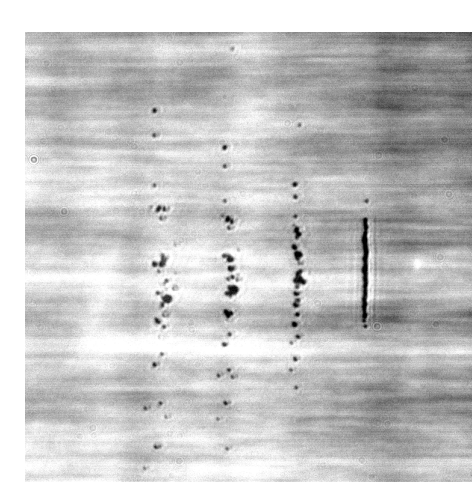
fast optical spectroscopy of tin and plasma products



the 10Hz tin droplet generator



ion detection



Stroboscopic shadowgraph imaging of droplets

Energy and mass resolved ion detection

High resolution mass spectrometry of ion species ejected from plasma.

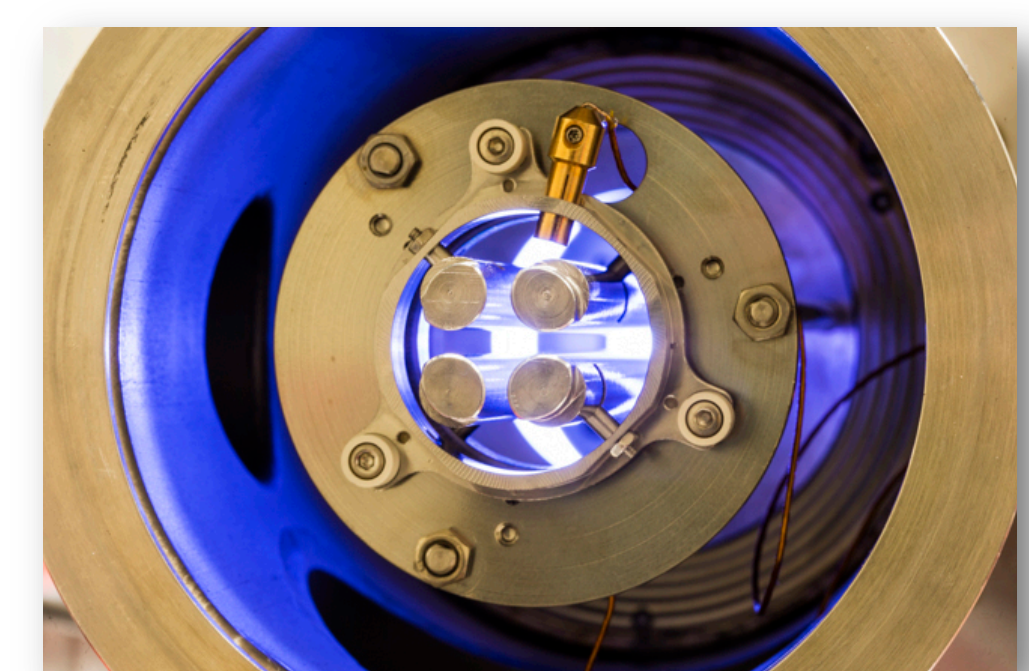
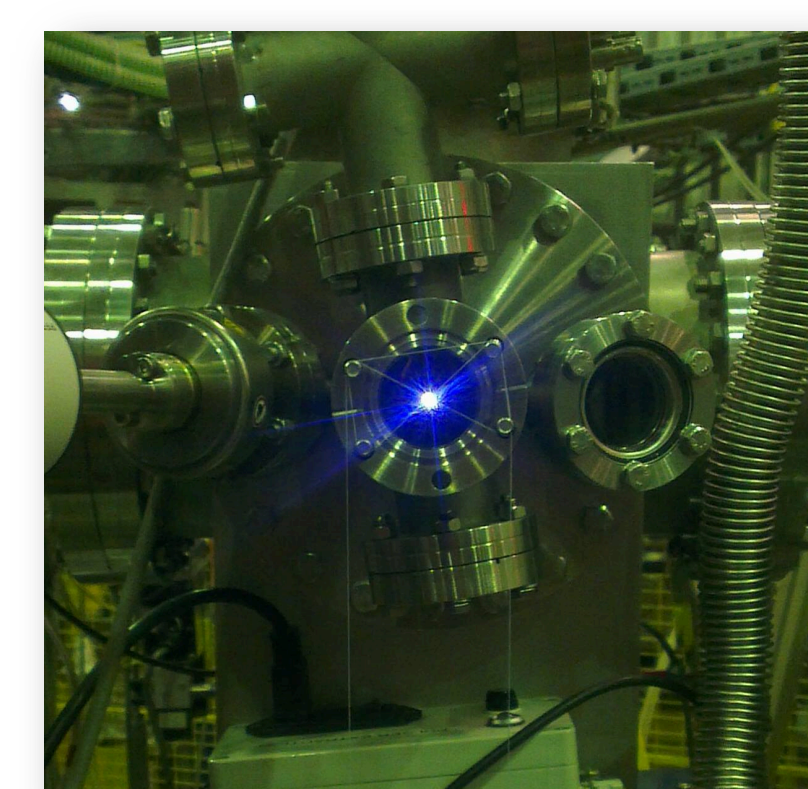
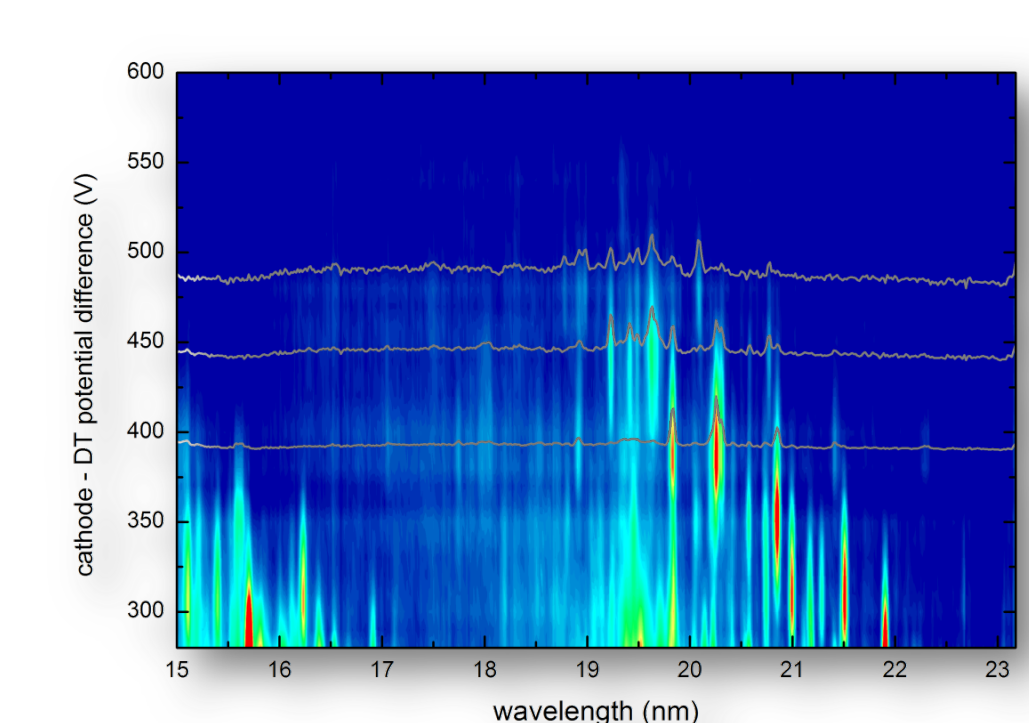
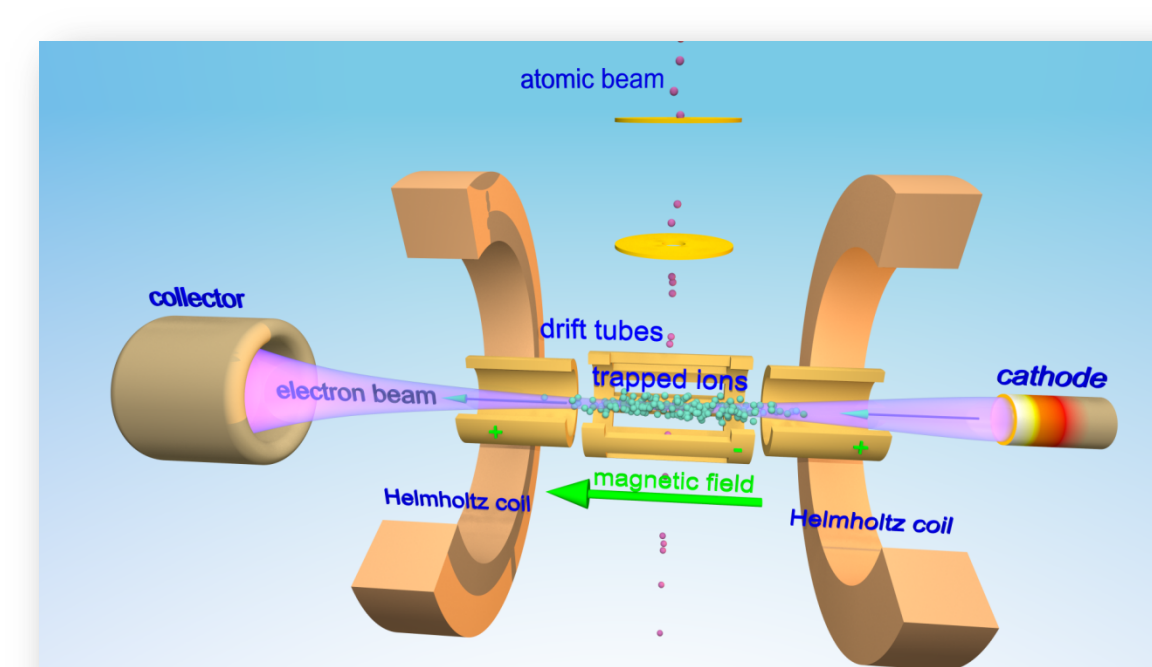


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Light-matter interactions are studied using ion traps at external facilities such as synchrotrons and free electron lasers (FEL).

Optical, DUV, and EUV spectroscopy of highly charged tin in an electron beam ion trap (EBIT)



What can we learn from line emission, in the optical or DUV regimes, of highly charged tin Sn^{8+} - Sn^{13+} ?

EBIT enables charge state resolved high-resolution spectroscopy, be it passive, or active, with laser, synchrotron, X-FEL radiation.

Which other ions are suitable? Next generation XUV lithography?